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Exploring indicators of extremity pain of spinal source as identified by Mechanical Diagnosis and Therapy (MDT): a secondary analysis of a prospective cohort study

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ABSTRACT

Objective: To explore indicators that predict whether patients with extremity pain have a spinal or extremity source of pain.

Methods: The data were from a prospective cohort study ($n = 369$). Potential indicators were gathered from a typical Mechanical Diagnosis and Therapy (MDT) history and examination. A stepwise logistic regression with a backward elimination was performed to determine which indicators predict classification into spinal or extremity source groups. A Receiver Operating Characteristic (ROC) curve was constructed to examine the number of significant indicators that could predict group classification.

Results: Five indicators were identified to predict group classification. Classification into the spinal group was associated with the presence of paresthesia [odds ratio (OR) 1.984], change in symptoms with sitting/neck or trunk flexion/turning neck/when still (OR 2.642), change in symptoms with posture change (OR 3.956), restrictions in spinal movements (OR 2.633), and no restrictions in extremity movements (OR 2.241). The optimal number of indicators for classification was two (sensitivity = 0.638, specificity = 0.807).

Discussion: This study provides guidance on clinical indicators that predict the source of symptoms for isolated extremity pain. The clinical indicators will allow clinicians to supplement their decision-making process in regard to spinal and extremity differentiation so as to appropriately target their examinations and interventions.

KEYWORDS

Differentiation; extremity pain; indicators; spinal source

Introduction

The possibility of isolated extremity musculoskeletal pain having a spinal source has been acknowledged in the literature. This has been well documented by neurophysiological studies, which have reported on referral patterns generated from specific spinal structures [1–5]. Varied spinal structures such as lumbar and cervical zygapophyseal joints [1–3], lumbar intervertebral disc [4] and lumbar multifidus muscles [5] have been shown to refer symptoms to the extremities. These studies provide potential neurophysiological explanations for spinal problems presenting as isolated extremity pain. However, neurophysiological studies do not provide a clinical perspective on prevalence or on how to examine/manage isolated extremity pain of spinal source. Clinical studies focusing on differentiation between spinal and extremity sources of symptoms do attempt to determine how certain examination/intervention strategies influence the symptomatic presentation. Clinical studies have reported on shoulder pain resulting from a spinal source [6–8] and the spine as a source for isolated hip

pain [9,10]. However, there has been a lack of data on prevalence of a spinal source from more distal joints such as the elbow, wrist, knee and ankle, despite spinal screening for extremity presentations being an accepted component of an orthopedic examination [11]. This has resulted in a lack of clear clinical guidelines for spinal screening [12] and no consensus or consistency in clinical practice [13].

Previous studies [6–8] focusing on differentiation between spinal and shoulder pathology have examined the proportion of patients with extremity pain that had a spinal source. In these clinical studies [6–8], prevalence rates of shoulder pain of a spinal source were reported between 10% and 29%. Karel et al. [6] did not report on the methodology that the clinicians utilized to classify shoulder pain of spinal pathology. Cannon et al. [7] reported the prevalence of shoulder impingement in patients with suspected cervical radiculopathy by conducting physical examination tests. For example, if crossed adduction, forward flexion or abduction with internal rotation reproduced the patient's symptoms, the patient was diagnosed as

having a shoulder impingement. Heidar Abady et al. [8] used clinicians trained in Mechanical Diagnosis and Therapy (MDT) to classify patients with shoulder pain into either spinal or extremity source, utilizing the MDT approach. Similar prevalence data from the lower extremity is not available as there is a real deficit of clinical studies exploring the proportion of isolated lower extremity pain of spinal source.

The lack of data on proportions of musculoskeletal extremity problems that respond to spinal interventions justified further exploration [14]. This was investigated utilizing the MDT approach and the prevalence was found to be at 43.5% [14]. This high rate suggests that clinicians should adequately screen patients presenting with extremity pain so that they can make appropriate management decisions.

Identifying a spinal source for isolated extremity pain that appears seemingly unrelated can be a diagnostic challenge. Establishing prognostic indicators from the history or physical examination would assist in the decision-making process by helping clinicians to evaluate the extent of the need for screening. Mintken et al. [15] reported on prognostic factors for patients with shoulder pain likely to experience improvement with cervicothoracic spine manipulation. They derived five different prognostic variables. These factors were pain-free shoulder flexion <127 degrees, shoulder internal rotation <53 degrees at 90 degrees of abduction, negative Neer test, not taking medications for their shoulder pain and symptoms less than 90 days. However, in a subsequent study by Mintken et al. [16], these factors could not be validated and therefore, they could not recommend their clinical use. Another study, completed by Gumina et al. [17] investigated the 'arm squeeze' test to differentiate between pain originating from the shoulder versus cervical nerve root compression. The test was shown to have high values of sensitivity (0.96) and specificity (0.91) providing good clinical utility, but it was specific only to cervical nerve root compression, not to a cervical source in general.

Walker et al. [13] reported on a case-based survey of health-care practitioners to investigate methods that clinicians used to examine the neck of a patient presenting with shoulder pain. They concluded that clinical practice is inconsistent and that this may be due to a lack of guidance from the literature. There is a dearth of information on how much time and energy a clinician should focus on spinal differentiation for isolated extremity pain. Providing clinicians with indicators that would guide them to predict the source of the pain would be valuable in facilitating the efficient use of resources and time. Clear indicators from the history or at the beginning of the physical examination would justify more time for differentiation, whereas few or no indicators would allow for more expediency in screening the spine. To our knowledge, there are no

previously validated clinical indicators of isolated extremity musculoskeletal pain of spinal source. The first step is identifying potential indicators of extremity pain of spinal source, followed by validating the findings in other studies. The objective of this study was to identify clinical indicators that predict whether patients with isolated lower or upper extremity pain have a spinal or extremity source of pain as classified by MDT trained clinicians. As this is an exploratory study, potential indicators were not hypothesized.

Methods

Study design

The data for this study were obtained from a prospective cohort study [8] that investigated the prevalence of isolated extremity pain which was deemed to be of spinal source. This study was conducted at four Physiotherapy clinical sites of which two were in Canada (for hospital employees), one in New Zealand and one in the United States of America (both orthopedic clinics). Data for this study were collected between January 2017 and April 2018. Ethical approval for the study was provided by Western University Research Ethics Board (London, Canada), New Zealand Ethics Committee and Pacific University Oregon Institutional Review Board (Forest Grove, USA).

Study participants

Consecutive patients who presented to the clinical sites with any extremity pain that neither the patient nor referring physician interpreted as having a spinal source were invited to participate. Inclusion criteria included: older than 15 years of age, able to attend and participate in exercise-based physiotherapy 2–3 times per week and be able to understand English. Exclusion criteria were pain linked with inflammatory conditions such as rheumatoid arthritis, evidence of recent trauma such as swelling or bruising, neurological conditions affecting function of the limbs, or attending physiotherapy for post-surgical rehabilitation. As this was a secondary analysis of a previous study [14], all participants from the original study ($n = 369$) were included and a formal sample size calculation was not completed. All participants provided written informed consent. Demographic information (e.g. age and sex) was collected from participants.

Evaluation/intervention

All participants were assessed and treated by the physiotherapists as they would normally assess and treat any patient using the MDT system. In the MDT system a provisional classification that guides the management

strategy is usually established during the initial visit. This provisional classification is then either accepted or rejected at follow-up evaluations based on the response of the patient to the exercise prescribed.

A key feature of the MDT examination which was applied during this study, is the process of establishing consistent baselines. These, for example, can be a baseline of symptoms, a restriction and/or pain with extremity movements or a functional activity baseline. A functional activity as simple as walking may be an appropriate baseline for someone presenting with lower extremity pain if their symptoms were consistently produced with walking. Another example may be a 'step up' with the affected extremity, for someone with knee pain. Once consistent baselines were established, the clinician screened the spine with end range repeated spinal movements such as, but not limited to, lumbar spine extension or flexion in standing using MDT principles [14]. Symptomatic response along with rechecking of baseline movements/activities following each set of repetitive movements was done to assess the effect of the repeated movements. The spine was examined in further detail to see if the spinal repeated movements had an effect on the symptoms or influenced the mechanical baselines. This would determine the presence or absence of a directional preference which refers to the direction of spinal movement that has a favorable effect on the symptoms. If the spinal repeated movements had no effect on the various baselines, then the extremity was examined in a similar manner following MDT principles. Once a consistent and repeatable effect was established, a provisional MDT classification for the source of the symptoms arising from the spine or the extremity was established and this provisional classification was either accepted or rejected as the final classification based on their response to the prescribed exercises on subsequent visits. Prescribed exercises for the spinal source group involved one exercise either performed repeatedly or sustained at end range in the direction of preference. Thus, participants were classified to either the spinal source group or extremity source group. Any participant who was classified to the spinal source group was solely managed with spinal treatment [14]. Further generic details of an MDT examination process are described in the original publication [14].

The spinal source group was instructed on repeated movements as a home exercise in the direction that they responded to the best. For example, if lumbar repeated extensions in lying improved the pain and baselines for the participant's hip pain, this was the exercise that was prescribed to the patient to be done regularly at home. For the extremity source group, the intervention provided was based on the MDT extremity classification. For example, with a classification of shoulder Contractile Dysfunction in the direction of

abduction, resisted repeated shoulder abduction exercises were prescribed. Follow-up visits either confirmed or rejected the provisional classification based on the participants response to the exercises prescribed. The source of the pain was considered to be spinal if the symptoms were resolved with spinal treatment only. Results of the prevalence of extremity pain of spinal source can be found in the original publication [14].

The term 'spinal source'

The term 'spinal source' is utilized throughout this article to denote an extremity presentation which was successfully managed with exclusive spinal exercise in the Rosedale et al. study [14]. Although most clinicians would assign the location being successfully treated as the 'source' of the problem, there is no means currently to confirm this supposition.

Indicators of response to spinal versus extremity source

As there were no previously validated indicators reported on predicting extremity pain of spinal source, informal clinical consensus between the study authors was used. Potential indicators were identified prospectively, prior to the beginning of data collection. Potential indicators were gathered from both the history and the physical examination during the initial visit by the treating clinician. Potential indicators that were deemed plausible to predict whether the extremity symptoms could be classified as having a spinal versus extremity source are reported below. The indicators from the history are routinely asked and documented on the standardized MDT extremity assessment forms by MDT clinicians. Similarly, the effect of posture change and evaluation of spinal and extremity movement is routinely evaluated and documented in an MDT physical examination. The information gathered on these indicators were extracted from the clinicians' forms.

Potential indicators gathered in the history and how they were coded:

- (1) Current spinal pain (0 = No, 1 = Yes).
- (2) History of spinal pain (0 = No, 1 = Yes).
- (3) Presence of paresthesia (0 = No, 1 = Yes).
- (4) Presence of symptoms proximal to the joint for which the participant was seeking care (0 = No, 1 = Yes).
- (5) Constant versus intermittent pain (0 = Intermittent, 1 = Constant).
- (6) Chronicity of the symptoms (0 = Acute/subacute was symptom duration less than 12 weeks; 1 = Chronic duration was symptoms greater than 12 weeks)

- (7) Coughing and sneezing increase symptoms (0 = No, 1 = Yes).
- (8) Effect on symptoms with sitting/neck or trunk flexion/turning the neck/when still (Participants were asked if their upper or lower extremity symptoms changed for the better or worse with sitting, bending forwards with their cervical or lumbar spine, turning their neck or if they remained still in one position, while not moving their trunk or extremities (0 = No change, 1 = Change).

Potential indicators gathered during the physical examination and how they were coded:

- (1) Posture change affected symptoms

Participants were asked to change their sitting posture, for example from an erect posture to a slumped (kyphotic) posture and then to an exaggerated erect posture (lordotic). The postures at their end range were sustained for 10–15 seconds and the participant was asked if these posture changes had an effect on their extremity symptoms (0 = No, 1 = Yes).

- (2) Perceived restriction of spinal movement

Participants were asked to actively perform spinal movements in all planes of movement. The movement was observed by the clinician and at the end range of their movement the patient was asked if they perceived that movement to be their normal or restricted by pain or stiffness. A restriction in the spinal movement was noted if reported by the patient and observed by the clinician. Additionally, spinal movement was monitored during and after repeated spinal movement testing and if there was a clear difference in the spinal range of motion in any plane then a spinal movement restriction was noted (0 = No, 1 = Yes).

- (3) No perceived restriction of extremity movement

This was established using the same process as described above for spinal movement except that the process was directed to a specific extremity joint (0 = No, 1 = Yes).

Statistical analysis

Descriptive statistics were collected for demographic variables. The frequency of symptoms reported in each region was determined for both extremity and spinal source group classification. Frequency counts were determined for the indicators. A stepwise logistic regression with a backward elimination was performed to determine which indicators predict classification into spinal or extremity source groups. The dependent

variable was the group (0 = extremity source; 1 = spinal source). All indicators were dichotomous. Indicators were removed if their associated p value was greater than 0.10. Odds ratio with 95% confidence intervals and associated p values were reported. The appropriateness of the logistic regression was examined including linearity and multicollinearity.

Secondary analyses included using the significant indicators from the logistic regression model to predict classification (spinal vs. extremity source) from the original sample and compare to the final classification. Sensitivity and specificity values were then calculated. Next, the number of significant indicators that each participant displayed was counted. A ROC curve was constructed to examine if the number of significant indicators could predict group classification. The area under the curve (AUC) with 95% confidence intervals and the optimal number of significant indicators, with associated sensitivity and specificity, were determined using the ROC curve.

Results

Initially, 369 participants were recruited. Some participants did not complete the study and were excluded ($n = 47$); 28 failed to attend for follow-up appointments, 6 sought or were directed elsewhere for therapy, 10 were unable or unwilling to attend further, 2 underwent surgery and 1 had subsequent trauma to the extremity area. Other participants had missing indicator data ($n = 3$) and were excluded. Demographic statistics for the remaining sample ($n = 319$; 231 females) are provided in Table 1. The proportion of participants for each pain region along with their group classification is shown in Table 2. Frequencies for the indicators are provided in Table 3. There were 181 participants (128 females) classified into the extremity source group and 138 participants (103 females) into the spinal source group. Increases in symptoms with coughing/sneezing was only found in 6 and 0 participants in the spinal and extremity source groups, respectively. Given this low prevalence, this indicator was not included in further analyses.

Table 1. Means (standard deviation) for the demographic variables.

Variable	Entire Sample ($n = 319$)	Extremity Source Group ($n = 181$)	Spinal Source Group ($n = 138$)
Age	47 (12)	47 (13)	48 (12)
Mass (kg)*	76.11 (16.83)	76.92 (16.97)	75.05 (16.66)
Height (m)*	1.70 (0.10)	1.70 (0.10)	1.69 (0.10)
Body mass index (kg/ m ²)*	26.40 (5.25)	26.50 (5.32)	26.26 (5.16)

* There is missing height data for 13 participants, and missing mass and body mass index data for 20 participants.

Table 2. Proportion of participants in each group for each pain region.

Pain Region	Extremity Source Frequency n(%) *	Spinal Source Frequency n (%) *
Ankle/foot	33 (70)	14(30)
Knee	58 (74)	20 (26)
Thigh/leg	5 (28)	13 (72)
Hip	9 (29)	22 (71)
Wrist/hand	16 (64)	9 (36)
Arm/forearm	2 (17)	10 (83)
Elbow	14 (58)	10 (42)
Shoulder	44 (52)	40 (48)

* The percentages for proportion of participants per each pain region add to 100% by going across each row.

Table 3. Frequency of indicators for both groups.

Variable	Classification	Extremity Source Group n (%)	Spinal Source Group n (%)
Current spinal pain	No	162 (90)	111 (80)
	Yes	19 (10)	27 (20)
History of spinal pain	No	101 (56)	59 (43)
	Yes	80 (44)	79 (57)
Presence of paresthesia	No	167 (92)	113 (82)
	Yes	14 (8)	25 (18)
Presence of symptoms proximal to the joint	No	153 (85)	90 (65)
	Yes	28 (15)	48 (35)
Constant versus intermittent pain	Intermittent	134 (74)	87 (63)
	Constant	47 (26)	51 (37)
Chronicity of the symptoms	Acute/ subacute	113 (62)	75 (54)
	Chronic	68 (38)	63 (46)
Coughing/sneezing increase symptoms	No	181 (100)	132 (96)
	Yes	0 (0)	6 (4)
Effect on symptoms with sitting/neck or trunk flexion/ turning neck/when still	No change	156 (86)	77 (56)
	Change	25 (14)	61 (44)
Posture change affects symptoms	No	160 (88)	69 (50)
	Yes	21 (12)	69 (50)
Restriction of spinal movement	No	144 (80)	68 (49)
	Yes	37 (20)	70 (51)
No Restriction of extremity movement	No	124 (69)	76 (55)
	Yes	57 (31)	62 (45)

For the logistic regression analysis, five indicators were retained in the final model (Table 4). Classification into the spinal source group was associated with the presence of paresthesia, a change in symptoms with sitting/neck or trunk flexion/turning neck/when still, changes in symptoms with posture change, restrictions in spinal movements, and no restrictions in extremity joint movements. The strongest indicator was changes in symptoms with posture change. Participants that had changes in symptoms with posture change were 3.956 times more likely to be classified into the spinal source group than the extremity source group.

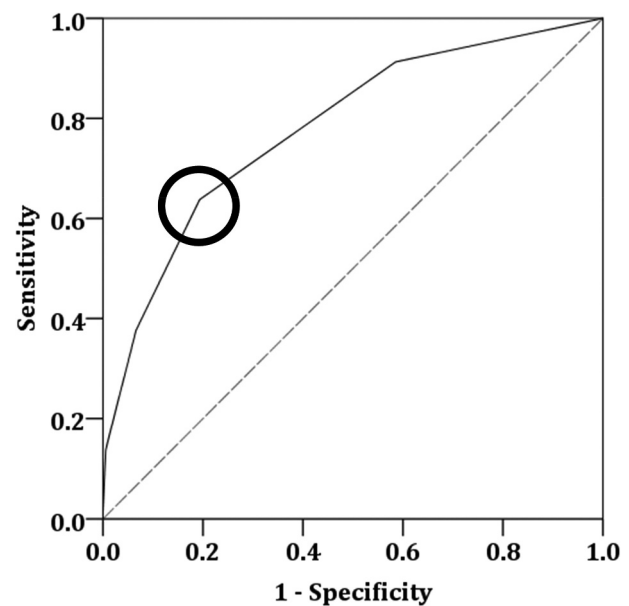
Using these five indicators from the model created by logistic regression to predict group classification resulted in a sensitivity of 0.616 and specificity of 0.823. The ROC curve (Figure 1) demonstrated the number of significant indicators that was able to significantly predict group classification (AUC = 0.781, 95% confidence interval = 0.730 to 0.832, $p < 0.001$). The optimal number of significant indicators for classification was 2 (sensitivity = 0.638, specificity = 0.807).

Table 4. Odds ratios and coefficients (b) from the logistic regression model for the intercept and significant indicators.

Indicator	Odds Ratio (95% CI)	p value	b (Standard Error)
Presence of paresthesia	1.984 (0.886, 4.443)	0.096	0.685 (0.411)
Effect on symptoms with sitting/neck or trunk flexion/ turning neck/when still	2.642 (1.421, 4.913)	0.002	0.972 (0.316)
Posture change affects symptoms	3.956 (2.094, 7.475)	<0.001	1.375 (0.325)
Restriction of spinal movement	2.633 (1.471, 4.712)	0.001	0.968 (0.297)
No Restriction of extremity movement	2.241 (1.301, 3.859)	0.004	0.807 (0.277)
Model intercept (constant)			-0.831 (0.232)

CI = Confidence Interval.

Source classification (0 = extremity source, 1 = spinal source); presence of paresthesia (0 = No, 1 = Yes); effect on symptoms with sitting/neck or trunk flexion/ turning neck/when still (0 = No change, 1 = Change); posture change affects symptoms (0 = No, 1 = Yes); restriction of spinal movement (0 = No, 1 = Yes); No restriction of extremity movement (0 = No, 1 = Yes).

**Figure 1.** Receiver Operating Characteristic (ROC) curve demonstrating the ability of the number of significant indicators (black line) to accurately classify extremity/spinal source of pain classification. The optimal number of significant indicators (2) is the value closest to the upper left corner (see the black circle). The gray line represents if a random variable was used to classification, which would have an area under the curve of 0.50.

Discussion

To our knowledge, this is one of the first studies to provide a combination of clinical indicators to predict a spinal source for isolated extremity pain. These clinical indicators need to be validated in subsequent studies. There were five significant clinical indicators that were associated with a spinal source: presence of

paresthesia, change in symptoms with sitting/neck or trunk flexion/turning neck/when still, change in symptoms with posture change, restriction in spinal movement and no restriction in extremity movement. The optimal number of indicators to predict classification was two, with a sensitivity of 0.638 and specificity of 0.807. This provides good clinical utility, allowing clinicians to use these indicators to determine the likelihood of a spinal source for extremity pain.

The significant clinical indicators reported included a combination of factors from the patient's history and the physical examination. Obtaining indicators during the history and at the start of the physical examination may be valuable in providing direction regarding where to best spend limited clinical time when attempting to provide effective and efficient services. The high specificity (0.807) in the presence of two indicators suggests a strong likelihood of having a spinal source of pain. However, the moderate sensitivity (0.638) suggests that a patient with less than two indicators would not necessarily have an extremity source of pain. Utilizing this information, a clinician can be timelier in the spinal/extremity differentiation if the majority of indicators are negative or, conversely, be more exhaustive if enough of the indicators are positive.

Clinicians might historically make assumptions regarding what may or may not predict a spinal source, and this is likely guided by training, clinical experience, and expert opinion. This clearly needs substantiation, as the level of evidence that clinicians should rely on is ideally based on appropriate research. Some of the clinical indicators found in this study would likely be seen as intuitive to most clinicians. Paresthesia and loss of spinal movement would commonly be assumed to be associated with a spinal related problem and thus more predictive [18]. The same could be said for the lack of extremity movement loss, which likely would be interpreted as more confirmatory of a spinal source of pain [19]. These indicators would routinely be evaluated during a standard orthopedic assessment [20] and so would need no modification in the screening process for the majority of clinicians. However, now clinicians have some verification that these observations can be used in the decision-making for differentiation with more confidence. Asking specifically about the effects of sitting, neck and trunk flexion, turning the neck or the effect on symptoms when the patient is still, may not be such a routine part of all clinician's history taking. However, this would be easy to integrate into the questioning on potential aggravating factors with the knowledge that they are helpful in the spinal/extremity differentiation process. The effect of a change in posture on baseline symptoms or on a provocative movement that produces pain may also not be such a routine part of many clinician's repertoire. The aim is to move the spine during this posture

change, with the extremities remaining relatively still and hence if the extremity symptoms change, it is more likely to indicate a spinal source. Since this is the assessment component with the largest predictive value, it may warrant the inclusion in non-MDT assessments to help clarify spinal/extremity differentiation. It is interesting to note that two factors which many clinicians may assume are predictive of a spinal source of pain, current spinal symptoms and a history of spinal symptoms [18], were not found to be significant indicators.

Despite limited previous research on this topic, especially with lower extremity pain, some of the indicators identified in this study had previously been described in cases of upper extremity pain presentation. In a case report [21] on shoulder pain where the authors concluded the pain to be of a spinal source, they also reported that there was no restriction of extremity movement, restricted spinal movement, and posture change also had an effect on the patient's extremity symptoms. In a pilot randomized controlled trial [22] investigating the effect of specific cervical mobilizations on shoulder pain, the authors reported shoulder pain being affected by the cervical mobilizations. However, in contrast to our indicator of restricted spinal movement, they reported no loss of spinal movement. In a more recently published case series [23] the authors reported on three cases of shoulder pain that all demonstrated a spinal source. Interestingly, in these cases they reported no extremity movement loss for 2 of the 3 cases and active shoulder movement being restricted due to pain in the third case. Maccio and colleagues [19] in their study exploring predictive variables for directional preference in extremity joints described similar findings to those reported here, with a lack of extremity movement loss and the presence of paresthesia as the factors that predicted spinal referral of symptoms. It is clear that the findings of our study are not dissimilar to what had previously been documented in the few studies that have explored questions related to the source of extremity symptoms.

In our previous study [14] the proportion of both isolated upper and lower extremity pain of spinal source was explored. The study had 175 participants with lower extremity symptoms of which 65 (39%) were classified to the spinal source group. Participants who presented with hip symptoms and thigh/leg (between the hip and knee joints/between the knee and ankle joints) symptoms had a significantly higher proportion of pain that was of a spinal source at 71% and 72 % respectively. The high proportion of hip/thigh pain being of spinal source is not surprising due to the close proximity to the spine along with this area being known as a referral area for the lumbar spine [24,25]. This would warrant clinicians to undertake a more thorough screening of these areas with a potential higher proportion of spinal involvement.

There are some limitations of this study. The sensitivity and specificity were determined on the same sample that was used to develop the initial model. Thus, the results would need to be confirmed on another sample to confirm the predictive ability of the indicators and to validate the model. As the differentiation was performed by clinicians using an MDT assessment including a repeated movement examination, the results may not be applicable to clinicians using other assessment approaches. However, clinicians' not using the MDT approach could easily incorporate investigating these indicators during their own examination process. The clinicians in the study followed the usual clinical process of documenting range restriction through observation as perceived by the patient and clinician and not objective measurements using goniometers or inclinometers, which are considered to have better reliability. The standard medical procedure for identifying a specific tissue as the 'source' of a symptom is a double joint injection. This procedure was not performed in this study as the study was not focused on identifying a specific tissue or structure, but a region as the source. Additionally, this study enrolled a heterogeneous group of participants to match what is typically seen in a clinical setting. This is a less controlled design than other methods (e.g. anesthetic block) that investigate the source of symptoms but our findings are more clinically valid.

Finally, only the factors which were initially set down as potential indicators were analyzed. There may be other indicators from the assessment that are predictive but were not analyzed as part of this study.

Conclusion

This study is one of the first to provide guidance on clinical indicators that predict a spinal source of symptoms for patients presenting with isolated extremity pain. The five indicators, most of which are commonly used in any orthopedic assessment, may allow clinicians to supplement their decision-making process in regard to spinal and extremity differentiation so as to appropriately target their examinations and interventions. Future research is required to validate the clinical indicators in other patient groups.

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